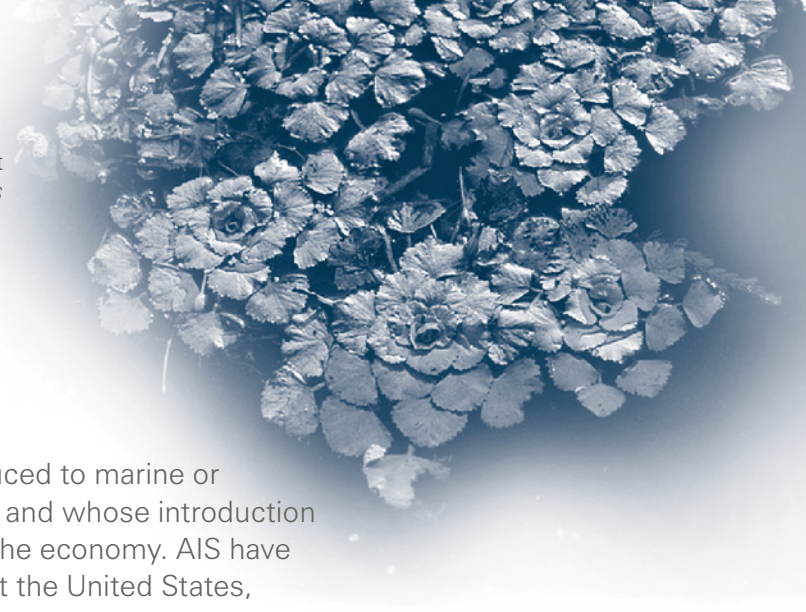


Water chestnut
Trapa natans

Introduction

Aquatic invasive species (AIS) are organisms introduced to marine or freshwater ecosystems to which they are not native and whose introduction causes harm to human health, the environment, or the economy. AIS have negative impacts on aquatic ecosystems throughout the United States, costing the nation billions of dollars annually in economic and ecological damages. AIS are considered one of the greatest threats to coastal environments and can significantly affect public water supplies; recreational activities, such as boating; and valuable natural resources, such as fisheries. Major pathways for AIS include:

- discharge of ships' ballast water
- fouling, such as barnacle growth, on commercial and recreational vessels
- accidental or intentional release of marine organisms intended for human consumption, aquaculture, bait, horticulture, aquaria, and the pet trade
- escape or unintended spread of nonnative biocontrol species

Prevention of AIS introductions is generally the most effective means of avoiding their establishment and spread. If prevention measures fail, the following steps are critical to managing AIS establishment and spread:

1. routine monitoring of aquatic ecosystems to detect AIS before they become widespread
2. rapid assessment of potential management options
3. rapid response to eradicate or control AIS

In many cases, eradication ("rapid response") actions must occur quickly, possibly even within a few days of the AIS introduction, to be effective. For this reason, natural resource managers are advised to identify and evaluate potential rapid response actions before species introductions even occur and prepare detailed rapid response plans that can be carried out quickly. If both prevention and rapid response actions fail, natural resource managers may be able to prevent further proliferation and/or minimize harmful AIS impacts by ongoing control of established AIS populations.

Sea lamprey
Petromyzon marinus

Examples of AIS Impacts:

- Nonnative fish in the Great Lakes, such as the round goby *Negobius melanostomus*, sea lamprey *Petromyzon marinus*, Eurasian ruffe *Gymnocephalus cernuus*, and alewife *Alosa pseudoharengus*, compete with native fish for food and habitat, significantly impacting Great Lakes food webs and sports fisheries.
- Nonnative plants, such as the common reed *Phragmites australis*, purple loosestrife *Lythrum salicaria*, and Eurasian milfoil *Myriophyllum spicatum*, have become established in the Great Lakes, displacing native plants that provide wildlife habitat and prevent erosion. Their prevalence in recreational waters also hinders swimming and boating.
- The nonnative infectious oyster disease MSX has devastated native oyster populations along the U.S. East Coast.
- The nonnative green crab *Carcinus maenas* competes with native fish and birds for food and preys on native bivalve populations along the U.S. West Coast, threatening Dungeness crab, clam, and oyster fisheries.
- The nonnative Chinese mitten crab *Eriocheir sinensis* burrows in intertidal stream banks and levies in California, undermining the structural integrity of the banks and causing severe erosion problems.
- The nonnative freshwater weed water hyacinth *Eichhornia crassipes* forms dense mats at the surface of water bodies throughout the United States, decreasing surface flow and preventing light and oxygen from reaching phytoplankton and submerged plants.

Caulerpa taxifolia

Caulerpa taxifolia is a highly invasive marine alga used to decorate saltwater aquaria. It is believed to have been introduced to several regions, including California, through aquaria releases. Once introduced, it spreads by fragmentation (even small fragments can form a new plant) and can form a dense carpet over rock, sand, and mud bottoms and native vegetation. It can also be transported between water bodies by boat anchors, fishing gear, and other equipment. In areas where it has become well-established, it has had a very detrimental impact on native marine communities, recreational boating and diving, and commercial fisheries.

Because *C. taxifolia* is easily spread and very difficult to eradicate, public education about safe disposal of aquaria contents and routine checking and cleaning of boat anchors, hulls, rudders, trailers, and fishing gear is critical to preventing invasions.

Zebra mussels
Dreissena polymorpha

In 1988, zebra mussels *Dreissena polymorpha* were inadvertently introduced to Lake St. Clair near Detroit, Michigan, and quickly spread throughout the Great Lakes and into many inland lakes, rivers, and canals. Since then, they have caused severe problems at power plants and municipal water supplies, clogging intake screens, pipes, and cooling systems. They have also nearly eliminated native clam populations in the Great Lakes.

To prevent the westward spread of zebra mussels and other AIS, the 100th Meridian Initiative, a cooperative effort between Federal, state, and Canadian provincial agencies, was started. The Initiative works to prevent the spread of zebra mussels by:

- informing and educating the public about the biology and impacts of zebra mussels and pathways for spreading zebra mussels
- voluntary boat inspections and boater surveys
- establishing monitoring sites to detect the presence of zebra mussels
- eradicating or containing zebra mussels if they are detected

For more information about the 100th Meridian Initiative, see ***www.100thmeridian.org***.

Chinese mitten crab
Eriocheir sinensis

Types of Rapid Response and Control Actions

There are three types of methods to eradicate and/or control AIS.

- **Chemical** methods involve the application of chemicals to eradicate and/or control AIS.
- **Mechanical and physical** methods involve the eradication and/or control of AIS by hand or machine or the alteration of the physical environment. Examples of mechanical and physical rapid response and control actions for invasive plants include manual cutting or picking, mowing, dredging, and shading to prevent photosynthesis. Examples of mechanical and physical rapid response and control actions for invasive animals include netting or trapping, smothering, and changing ambient water temperature.
- **Biological** methods involve the introduction of parasites, predators, or pathogens to the environment to control AIS. Biological methods are not generally considered rapid response methods because they typically take considerable time to develop and achieve results and they generally reduce, rather than eradicate, target populations.

The three types of eradication and control methods are not mutually exclusive because sometimes they can be used in combination and because some actions might belong to multiple categories. For example, the application of a saline solution to water bodies to eradicate or control AIS could be considered both a chemical and a physical action.

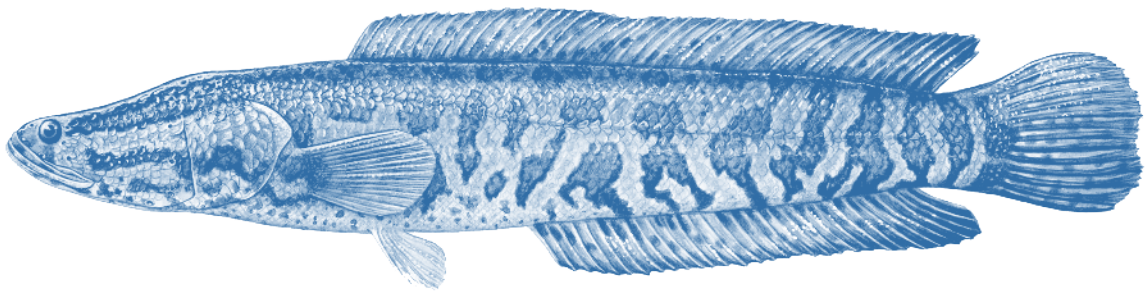
Eurasian watermilfoil
Myriophyllum spicatum

Examples of Rapid Response and Control Actions

It can be very difficult to eradicate or control AIS because both AIS and control agents, such as pesticides, are relatively easily spread. Examples of successful rapid response and control actions in aquatic environments are:

- The marine alga *Caulerpa taxifolia*, which is highly invasive in the Mediterranean, was eradicated from two coastal locations in southern California. Natural resource managers covered the *C. taxifolia* infestations with tarps and then injected chlorine beneath the tarps to destroy the alga (Chemical control method).
- The marine mussel *Mytilopsis* sp., a close relative of the zebra mussel *Dreissena polymorpha*, was eradicated from Darwin Harbor in Australia. Chlorine and copper sulphate were added to the waters of three hydraulically and physically locked marinas, and fouled vessels that were inside the infested marinas were hauled out and cleaned (Chemical and mechanical/physical control methods).
- The northern snakehead *Channa argus*, a large, nonnative predatory fish, was eradicated from several small ponds in Maryland. Herbicides were applied to the ponds to remove potential fish refuges and then a piscicide was used to kill the snakeheads in the ponds (Chemical control method).

If rapid response actions are not initiated or do not result in AIS eradication, ongoing control of AIS could be very costly. While there is no credible, comprehensive estimate of what AIS cost the United States economy, it is estimated that control costs in the United States for the invasive marsh weed European purple loosestrife *Lythrum salicaria* are $45 million annually, and fouling damages in the United States from the invasive shipworm *Teredo navalis* are $1 billion annually.[1]



Northern snakehead
Channa argus

[1] For estimates of invasive species control costs, see Pimentel, D., L. Lach, R. Zuniga, D. Morrison (2000) *Environmental and economic costs of nonindigenous species in the United States*. BioScience 50(1): 53-65.

Green crab
Carcinus maenas

A Tool for State and Local Natural Resource Managers

Because AIS can have substantial impacts on local environments and economies, and states and localities are often the first responders to aquatic invasions, EPA is providing this tool for state and local natural resource managers. The document provides an overview of EPA authorities that might apply to state or local AIS rapid response and control actions. The document:

- summarizes relevant Sections of the Clean Water Act (CWA) and the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
- summarizes how to apply for CWA Section 404 permits to discharge dredged or fill material
- summarizes how to apply for FIFRA Section 18 emergency exemptions and FIFRA Section 24(c) special local need registrations
- describes case studies in which state and local natural resource managers successfully obtained FIFRA emergency exemptions and special local need registrations for AIS eradication or control actions

This document can be found on EPA's website at *www.epa.gov/owow/invasive_species*.

Common reed
Phragmites australis